CLAIMS

What is claimed is:

1. A method, comprising operating an optical fan-out and broadcast interconnect including:

fanning-out an optical signal from an optical signal emitter, of one of a plurality of nodes, with a diverging element of one of a plurality of optics; and

broadcasting the optical signal to one of a plurality of receivers of all of the plurality of nodes with a light collecting and focusing element of all of the plurality of optics,

wherein the plurality of optics are positioned to define an optics array, the plurality of receivers are positioned to define a receiver array that corresponds to the optics array and the plurality of nodes are positioned to define a node array that substantially corresponds to the receiver array and the optics array.

2. The method of claim 1, further comprising reflecting the optical signal from a reflective structure after fanning-out and before broadcasting.

3. The method of claim 1, further comprising

fanning-out another optical signal; and

broadcasting the another optical signal to one of the plurality of receivers of all of the plurality of nodes with the light collecting and focusing element of all of the plurality of optics,

wherein the two optical signals are characterized by two different wavelengths.

4. The method of claim 1, further comprising

fanning-out another optical signal; and

broadcasting the another optical signal to one of the plurality of receivers of all of the plurality of nodes with a light collecting and focusing element of all of the plurality of optics,

wherein the two optical signals are aggregated to increase a total power of the optical signals.

5. The method of claim 1, further comprising

transmitting the optical signal through a distribution mirror; and

broadcasting the optical signal to one of another plurality of receivers of all of another plurality of nodes with another light collecting and focusing element of all of another plurality of optics.

6. The method of claim 5, wherein the distribution mirror includes a partially reflective mirror.

7. The method of claim 6, wherein the optical signal includes a wavefront.

8. The method of claim 7, wherein the wavefront includes information.

9. An apparatus, comprising an optical fan-out and broadcast interconnect including:

a plurality of nodes positioned to define a node array, each of the plurality of nodes having an optical signal emitter and a plurality of optical signal receivers positioned to define a receiver array that substantially corresponds to the node array; and

a plurality of optics optically coupled to the array of nodes, the plurality of optics positioned to define an optics array that substantially corresponds to the node array and the receiver array, each of the plurality of optics including a diverging element and a light collecting and focusing element,

wherein an optical signal from the optical signal emitter is fanned-out by the diverging element of one of the optics and broadcast to one of the plurality of receivers of all of the plurality of nodes by the light collecting and focusing element of all of the plurality of optics.

10. The apparatus of claim 9, wherein the optical signal emitter of all of the plurality of nodes and the plurality of optical signal receivers of all of the plurality of nodes are substantially coplanar.

11. The apparatus of claim 10, wherein all of the plurality of nodes are located on a single semiconductor wafer.

12. The apparatus of claim 9, wherein the optical signal emitter comprises a cluster of emitters.

13. The apparatus of claim 9, wherein each of the plurality of receivers comprises a cluster of receivers.

14. The apparatus of claim 9, wherein each of the plurality of nodes has a plurality of optical signal emitters and each of the plurality of optics has a plurality of diverging elements.

15. The apparatus of claim 14, wherein each of the plurality of nodes includes a plurality of modules and each of the plurality of optical signal emitters is associated with only one of the plurality of modules.

16. The apparatus of claim 9, wherein each of the plurality of nodes includes an electro-optic layer, wherein the electro-optic layer in includes a driver circuit coupled to the optical signal emitter and a plurality of amplifiers coupled to the plurality of receivers.

17. The apparatus of claim 9, wherein each of the plurality of nodes includes a plurality of modules.

18. The apparatus of claim 9, wherein the diverging element of all of the plurality of optics and the light collecting and focusing element of all of the plurality of optics are substantially coplanar.

19. The apparatus of claim 9, wherein at least a subset of the plurality of optics are asymmetrically positioned with regard to at least one member selected from the group consisting

of the node array and the receiver array to improve registration of optical signals with the plurality of receivers that define the receiver array.

20. The apparatus of claim 9, wherein at least one member selected from the group consisting of the diverging element and the light collecting and focusing element includes a Fresnel element.

21. The apparatus of claim 9, further comprising a plurality of microlens arrays coupled between the plurality of optics and the plurality of nodes, each of the plurality of microlens arrays substantially corresponding to the receiver array.

22. The apparatus of claim 9, wherein at least one member selected from the group consisting of the diverging element and the light collecting and focusing element includes an aspheric element.

23. The apparatus of claim 9, further comprising a reflective structure optically coupled to the array of optics, wherein the optical signal is reflected by the reflective structure after the optical signal is fanned-out and before the optical signal is broadcast.

24. The apparatus of claim 23, wherein the reflective structure includes a mirror.

25. The apparatus of claim 23, wherein the mirror is partially transmissive.

26. The apparatus of claim 23, wherein the mirror is dichroic.

27. The apparatus of claim 23, wherein the mirror is non-planar.

28. The apparatus of claim 23, wherein the reflective structure includes a diffuse reflector.

29. The apparatus of claim 23, wherein the reflective structure includes a positioner to adjust an alignment of the reflective structure with regard to the plurality of optics.

30. The apparatus of claim 9, further comprising a light baffle coupled between the plurality of nodes and the plurality of optics.

31. The apparatus of claim 30, wherein the light baffle defines a baffle array that substantially corresponds to the optics array, the node array and the receiver array.

32. The apparatus of claim 9, further comprising a power bus electrically coupled to the plurality of nodes.

33. The apparatus of claim 32, wherein the power bus includes a first conductive strip separated from a second conductive strip by dielectric layer.

34. The apparatus of claim 32, wherein the power bus includes is electrically connected to the plurality of nodes via flexible power tabs.

35. The apparatus of claim 9, further comprising a heat sink coupled to the plurality of nodes.

36. The apparatus of claim 9, further comprising an enclosure surrounding the plurality of nodes and the plurality of optics.

37. The apparatus of claim 36, wherein the enclosure contains a gas that forms a plasma discharge when ignited by the optical signal emitter.

38. The apparatus of claim 9, wherein the optical fan-out and broadcast interconnect includes a free-space optical fan-out and broadcast interconnect.

39. The apparatus of claim 9, wherein at least a subset of the plurality of receivers are asymmetrically positioned with regard to at least one member selected from the group consisting of the node array and the optics array to improve registration of optical signals with the plurality of receivers that define the receiver array.

40. The apparatus of claim 9, further comprising another optical fan-out and broadcast interconnect including:

another plurality of nodes positioned to define another node array, each of the another plurality of nodes having another optical signal emitter and another plurality of optical signal receivers positioned to define another receiver array that corresponds to the another node array; and

another plurality of optics optically coupled to the another array of nodes, the another plurality of optics positioned to define another optics array that corresponds to the another node array and the another receiver array, each of the another plurality of optics including another diverging element and another light collecting and focusing element,

wherein another optical signal from the another optical signal emitter is fanned-out by the another diverging element of one of the optics, broadcast to one of the another plurality of receivers of all of the another plurality of nodes by the another light collecting and focusing element of all of the another plurality of optics and broadcast to one of the plurality of receivers of all of the plurality of nodes.

41. The apparatus of claim 40, further comprising a systolic mirror optically coupled between the optical fan-out and broadcast interconnects, wherein the pluralities of optics include a relaying lens array.

42. A computer, comprising the apparatus of claim 9.

43. A network, comprising the computer of claim 42.

44. An optical switch, comprising the apparatus of claim 9.

45. A network, comprising the optical switch of claim 44.

46. A method, comprising operating a lightnode including:
fanning-out an optical signal through a diverging element;
broadcasting the optical signal through a light collecting and focusing element; and
receiving the optical signal with one of a plurality of receivers,
wherein the plurality of receivers are positioned to define a receiver array.

47. The method of claim 46 wherein the light collecting and focusing element is one of a plurality of optics that define an optics array that substantially corresponds to the receiver array.

48. The method of claim 46, further comprising reflecting the optical signal from a reflective structure after fanning-out and before broadcasting.

49. The method of claim 46, further comprising
fanning-out another optical signal;
broadcasting the another optical signal through the light collecting and focusing element; and
receiving the another optical signal with the plurality of receivers,

50. The method of claim 49, wherein the another optical signal is received by the one of the plurality of receivers.

51. The method of claim 50, wherein the two optical signals are characterized by two different wavelengths.

52. The method of claim 50, wherein the two optical signals are aggregated to increase a total

power of the optical signals.

53. The method of claim 46, further comprising

transmitting the optical signal through a distribution mirror; and

broadcasting the optical signal to one of another plurality of receivers of all of a plurality of nodes with another light collecting and focusing element of all of a plurality of optics.

54. The method of claim 53, wherein the distribution mirror includes a partially reflective mirror.

55. The method of claim 46, wherein the optical signal includes a wavefront.

56. The method of claim 55, wherein the wavefront includes information.

57. An apparatus, comprising a lightnode including:

a diverging element;

a light collecting and focusing element optically coupled to the diverging element; and

a receiver array optically coupled to the light collecting and focusing element, the receiver array having a plurality of optical signal receivers positioned to define the receiver array.

58. The apparatus of claim 57, further comprising a plurality of optical signal emitters, at least one of which is optically coupled to the spreading optic.

59. The apparatus of claim 57, further comprising a reflective structure optically coupled between the diverging element and the light collecting and focusing element.

60. The apparatus of claim 57, wherein each of the plurality of optical signal receivers comprises a cluster of optical signal receivers.

61. The apparatus of claim 57, wherein the diverging element and the light collecting and focusing element are substantially coplanar.

62. The apparatus of claim 57, wherein the light collecting and focusing element is asymmetrically positioned with regard to the receiver array to improve registration of optical signals with the plurality of receivers that define the receiver array.

63. The apparatus of claim 57, wherein at least one member selected from the group consisting of the diverging element and the light collecting and focusing element includes a Fresnel element.

64. The apparatus of claim 57, further comprising a microlens array coupled between the light collection and focusing element and the receiver array, the microlens array substantially corresponding to the receiver array.

65. The apparatus of claim 57, wherein at least one member selected from the group consisting of the diverging element and the light collecting and focusing element includes an aspheric element.

66. The apparatus of claim 57, further comprising a light baffle coupled between the array of receivers and at least one member selected from the group consisting of the diverging element and the light collecting and focusing element.

67. The apparatus of claim 57, further comprising a power bus electrically coupled to the array of receivers.

68. The apparatus of claim 57, further comprising a heat sink coupled to the array of receivers.

69. The apparatus of claim 57, further comprising an enclosure surrounding the array of receivers and the light collecting and focusing element.

70. The apparatus of claim 57, wherein the lightnode includes a free-space optical fan-out and broadcast lightnode.

71. The apparatus of claim 57, wherein at least a subset of the plurality of receivers are asymmetrically positioned with regard to the light collecting and focusing element to improve registration of optical signals with the plurality of receivers that define the receiver array.

72. A computer, comprising the apparatus of claim 57.

73. A network, comprising the computer of claim 72.

74. An optical switch, comprising the apparatus of claim 57.

75. A network, comprising the optical switch of claim 74.

76. An apparatus, comprising a node array including a plurality of nodes positioned to define the node array, each of the plurality of nodes having an optical signal emitter and a plurality of optical signal receivers positioned to define a receiver array that substantially corresponds to the node array.

77. The apparatus of claim 76, further comprising an optic array optically coupled to the node array, the optic array including a plurality of optics positioned to define the optics array, each of the plurality of optics including a diverging element and a light collecting and focusing element.

78. The apparatus of claim 76, further comprising a reflective structure optically coupled to the node array.

79. The apparatus of claim 76, wherein the optical signal emitter of all of the plurality of nodes and the plurality of optical signal receivers of all of the plurality of nodes are substantially coplanar.

80. The apparatus of claim 79, wherein all of the plurality of nodes are located on a single semiconductor wafer.

81. The apparatus of claim 76, wherein the optical signal emitter comprises a cluster of emitters.

82. The apparatus of claim 76, wherein each of the plurality of receivers comprises a cluster of receivers.

83. The apparatus of claim 76, wherein each of the plurality of nodes has a plurality of optical signal emitters.

84. The apparatus of claim 76, further comprising a light baffle coupled to the plurality of nodes.

85. The apparatus of claim 84, wherein the light baffle defines a baffle array that substantially corresponds to the node array and the receiver array.

86. The apparatus of claim 76, further comprising a power bus electrically coupled to the plurality of nodes.

87. The apparatus of claim 76, further comprising a heat sink coupled to the plurality of nodes.

88. The apparatus of claim 76, further comprising an enclosure surrounding the plurality of nodes.

89. The apparatus of claim 88, wherein the enclosure contains a gas that forms a plasma discharge when ignited by the optical signal emitter.

90. The apparatus of claim 76, wherein at least a subset of the plurality of receivers are asymmetrically positioned with regard to the node array to improve registration of optical signals with the plurality of receivers that define the receiver array.

91. A computer, comprising the apparatus of claim 76.

92. A network, comprising the computer of claim 91.

93. An optical switch, comprising the apparatus of claim 76.

94. A network, comprising the optical switch of claim 93.

95. An apparatus, comprising an optic array including a plurality of optics positioned to define the optics array, each of the plurality of optics including a diverging element and a light collecting and focusing element.

96. The apparatus of claim 95, further comprising a node array optically coupled to the optic array, the node array including a plurality of nodes positioned to define the node array, each of the plurality of nodes having an optical signal emitter and a plurality of optical signal receivers positioned to define a receiver array that substantially corresponds to the node array.

97. The apparatus of claim 95, further comprising a reflective structure optically coupled to the optic array.

98. The apparatus of claim 95, wherein each of the plurality of optics has a plurality of diverging elements.

99. The apparatus of claim 95, wherein the diverging element of all of the plurality of optics and the light collecting and focusing element of all of the plurality of optics are substantially coplanar.

100. The apparatus of claim 95, wherein at least one member selected from the group consisting of the diverging element and the light collecting and focusing element includes a Fresnel element.

101. The apparatus of claim 95, further comprising a plurality of microlens arrays coupled to the plurality of optics.

102. The apparatus of claim 95, wherein at least one member selected from the group consisting of the diverging element and the light collecting and focusing element includes an aspheric element.

103. The apparatus of claim 95, further comprising a light baffle coupled to the plurality of optics.

104. The apparatus of claim 103, wherein the light baffle defines a baffle array that substantially corresponds to the optics array.

105. The apparatus of claim 95, further comprising an enclosure surrounding the plurality of optics.

106. A computer, comprising the apparatus of claim 95.

107. A network, comprising the computer of claim 106.

108. An optical switch, comprising the apparatus of claim 95.

109. A network, comprising the optical switch of claim 108.

110. A method, comprising operating a fan-out and broadcast interconnect including:

fanning-out a signal from a signal emitter, of one of a plurality of nodes, with a diverging element of one of a plurality of fan-out and broadcast structures; and

broadcasting the signal to one of a plurality of receivers of all of the plurality of nodes with a converging element of all of the plurality of fan-out and broadcast structures,

wherein the plurality of fan-out and broadcast structures are positioned to define a fan-out and broadcast structure array, the plurality of receivers are positioned to define a receiver array that corresponds to the fan-out and broadcast structure array and the plurality of nodes are positioned to define a node array that substantially corresponds to the receiver array and the fan-out and broadcast structure array.

111. The method of claim 110, wherein the signal includes at least one member selected from the group consisting of an acoustical signal, an electrical signal, a radio frequency signal and an optical signal.

112. The method of claim 110, further comprising reflecting the signal from a reflective structure after fanning-out and before broadcasting.

113. The method of claim 110, further comprising

fanning-out another signal; and

broadcasting the another signal to one of the plurality of receivers of all of the plurality of nodes with the converging element of all of the plurality of fan-out and broadcast structures,

wherein the two signals are characterized by two different wavelengths.

114. The method of claim 110, further comprising

fanning-out another signal; and

broadcasting the another signal to one of the plurality of receivers of all of the plurality of nodes with the converging element of all of the plurality of fan-out and broadcast structures,

wherein the two signals are aggregated to increase a total power of the signals.

115. The method of claim 110, further comprising

transmitting the signal through a distribution structure; and

broadcasting the signal to one of another plurality of receivers of all of another plurality of nodes with another converging element of all of another plurality of fan-out and broadcast structures.

116. The method of claim 115, wherein signal includes an optical signal and the distribution structure includes a partially reflective mirror.

117. The method of claim 110, wherein the signal includes a wavefront.

118. The method of claim 117, wherein the wavefront includes information.